

INDOOR AIR QUALITY ASSESSMENT

**Roxbury District Court
85 Warren Street
Boston, Massachusetts**



Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
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Background/Introduction

At the request of the Massachusetts Executive Office of Health and Human Services (EOHHS), the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH) provided assistance and consultation initially regarding indoor air quality concerns at the Massachusetts Department of Mental Health's (MDMH) Roxbury Court Clinic (RCC) located at the Roxbury District Court (RDC), 85 Warren Street, Boston, Massachusetts. The request was prompted by reports of occupant complaints of symptoms (i.e., joint swelling/pain), and concerns over a possible connection to environmental conditions within the building, most notably chronic water damage and mold growth. Subsequent to the evaluation of the MDMH clinic space, follow up visits were made to evaluate the entire building.

The RDC (but not the areas occupied by the MDMH/RCC) has been visited several times previously by the Massachusetts Department of Labor and Workforce Development (MDLWD), Division of Occupational Safety (DOS) at the request of RDC employees. In June of 2002 the RDC was visited by DOS to investigate illness among RDC employees that they alleged to be associated with water damage from leaks in the building. DOS prepared a report containing a number of recommendations (MDLWD, 2002). In October of 2004, DOS visited the RDC in response to RDC employee complaints of poor indoor air quality, respiratory problems and rodent infestation. DOS prepared a report containing a number of recommendations to improve conditions in the building (MDLWD, 2004).

On March 9, 2006, a visit to the MDMH/RCC to conduct an indoor air quality assessment and collect samples for analysis for the presence of mold was made by Cory Holmes, an Environmental Analyst in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program and Elaine Krueger, Director CEH's Environmental Toxicology Program (ETP). CEH

staff were accompanied by Ronnie Michaels, Area Forensic Director, MDMH, during the assessment. For portions of the assessment, Mike Lane, Administrative Office of the Trial Court; Mary Jane McSweeney, Court Facilities Bureau, RDC and Tyrone Whitley, Facilities Manager, RDC accompanied CEH and MDMH staff.

On March 14 and 15, 2006, CEH staff returned to the RDC to evaluate the remainder of the building. On March 14, 2006, Mike Feeney, Director of the ER/IAQ Program was accompanied by Sharon Lee, an Environmental Analyst in CEH's ER/IAQ Program, Mr. Holmes and for portions of the assessment Mr. Michaels. On March 15, 2006, Mr. Holmes and Ms. Lee returned to the RDC to conduct mold sampling in selected areas throughout the RDC.

The RDC is a three-story triangular building that was constructed in the early 1970s ([Map 1](#)). The building has undergone interior renovation over the years, most recently in 1993. Windows are openable throughout the building. The MDMH/RCC occupies a suite of offices on the 3rd floor of the building. On the day prior to the CEH assessment (March 8, 2006), minor repairs for wall damage had been conducted in several areas in the MDMH office suite. More comprehensive interior renovations (i.e., replacement of ceiling tile systems, wall repairs and replacement of carpeting) were scheduled for the evening of March 9, 2006.

During the March 9, 2006 visit, Mr. Holmes recommended to Mr. Lane that any remediation of water-damaged/mold contaminated materials be done in a manner consistent with recommendations in "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001). Mr. Lane explained that he was familiar with the document and that the area of renovations would be isolated and be put under negative pressure during renovations to prevent the migration of materials to adjacent areas. Mr. Lane also reported that once renovations were complete, the areas would be cleaned using high

efficiency particulate arrestance (HEPA) filter equipped vacuum cleaners in conjunction with wet wiping of all surfaces.

Methods

CEH staff performed a visual inspection of building materials for water damage and/or microbial growth. CEH staff collected bulk and tape samples of building materials and surfaces for subsequent mold analysis. Bulk samples of materials that appeared to be mold-contaminated were removed using a scalpel and/or hemostats, then placed in a plastic Ziploc[®] bag. Tape samples were also taken by applying clear adhesive tape to the sample surface, mounting the tape onto microscope slides, and sealing the slides in plastic zip lock bags. Tape samples were taken from areas of visible water damage or mold growth as well as areas where no water damage was present for comparison. Bulk and tape samples were delivered directly to the Harvard School of Public Health Microbiology Laboratory by CEH staff for analysis following the assessments on March 9, and 15, 2006.

Moisture content of porous building materials (i.e., gypsum wallboard, ceiling tiles and carpeting), were measured with Delmhorst, BD-2000 Model, Moisture Detector with a Delmhorst Standard Probe. Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor. Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551.

Results

The RDC contains approximately 200 employees and can be visited by several hundred people a day. The MDMH/RCC is occupied by 3 full-time MDMH employees. Other state

employees may also utilize MDMH/RCC office space, which can be visited by up to 20 clients/members of the public daily. The tests were taken while MDMH/RCC offices were unoccupied due to renovations. Tests in the remainder of the RDC were taken during normal operations. Test results for general IAQ parameters (i.e., temperature, relative humidity and carbon dioxide) appear in Tables 1 and 2. Results of moisture testing appear in Tables 3 and 4. Microbiological results are included as Tables 5 and 6.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels in the RDC were below 800 parts per million (ppm) in all but five areas surveyed during the overall assessment. However, as indicated, the MDMH/RCC area was unoccupied at the time of the assessment, which can greatly reduce carbon dioxide levels. Therefore test results in the MDMH/RCC space do not reflect actual working conditions. Carbon dioxide levels would be expected to be higher with increased occupancy.

Mechanical ventilation for the original building is provided by air-handling units (AHUs) located in a rooftop penthouse (Picture 1). Fresh air is drawn into the AHUs through an air intake located on the exterior of the penthouse (Picture 2) and delivered to occupied areas via ceiling-mounted air diffusers (Picture 3). Exhaust air is drawn into an above ceiling plenum via grilled vents (Picture 4) and ducted to exhaust vents located in the penthouse (Picture 5).

Mechanical ventilation for areas in the 1993 addition is provided by a rooftop AHU (Picture 6). Fresh air is drawn into this AHU through an air intake located on the exterior of the cabinet and delivered to occupied areas via ceiling-mounted air diffusers. Local airflow to each

air diffuser is controlled by a variable air volume (VAV) box (Picture 7). Each VAV box has a set of thermostat-controlled dampers that open or close depending on the temperature demand for a serviced area. Once the thermostat detects that the temperature has reached a predetermined level, the VAV box dampers close until heating or cooling is needed. VAV boxes also control the provision of fresh air to a serviced space. During times that the temperature of a space is adequate, the VAV box closes its damper and limits the amount of fresh air. In contrast, if the thermostat calls for the HVAC system to provide heat, the AHU fresh air intake damper would close to increase the temperature of the air in the ductwork and occupied spaces. Airflow would be noted from the ceiling air diffusers because the VAV box dampers are open, but fresh air supply would be limited by the closing of the rooftop fresh air intake damper.

While VAV box systems have the advantage of energy conservation and lower operating costs, these systems may cause problems due to insufficient outside air supply. For example, once the temperature requirement is met, airflow drops. Airflow can drop to zero in poorly performing HVAC systems (Plog, Niland and Quinlan, 1996). Please note that this condition may occur during times of outdoor temperature extremes ($< 32^{\circ}\text{F}$ or $>90^{\circ}\text{F}$). Air monitoring was conducted on a day with comfortable outdoor conditions (72°F). To ascertain whether minimal airflow conditions exist, air monitoring during temperature extremes should be considered.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from

the room. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see [Appendix A](#).

On March 9, 2006, temperature readings in the MDMH/RCC ranged from 73° F to 78° F; on March 14, 2006 temperature readings in the RDC ranged from 70° F to 78° F. Temperature

ranges were within the MDPH recommended comfort guidelines during both days of the assessment. The MDPH recommends that indoor air temperatures be maintained in a range of 70° F to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

On March 9, 2006, the relative humidity measured in the MDMH/RCC ranged from 19 to 24 percent, which was below the MDPH recommended comfort range in all areas surveyed. On March 14, 2006, the relative humidity measured in the RDC ranged from 41 to 54 percent, which was within the MDPH recommended comfort range in all areas surveyed. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

Visible mold growth was observed and confirmed by tape samples collected from a number of different surfaces in both the MDMH/RCC and RDC, including:

- GW behind vinyl coving at the base of the walls in rooms 314, 317 and the storage room (Pictures 8-10);
- Painted walls in the MDMH storage room (Picture 11);
- Pipe insulation above ceiling tiles in room 314 and outside of room 330 (Picture 12);
- Ceiling tile in the DA's office and Clerk's area (Pictures 13 and 14);

- Bottom of a book on the windowsill of room 165 (Picture 15);
- Cardboard folders and paper files in a file cabinet in storeroom 112 (Picture 16);
- Water-damaged newspaper beneath plants in the first floor office area (near fire alarm control door) (Picture 17); and on
- bottom of a wicker basket containing a plant in room 316 (Picture 18) (Tables 5 and 6).

In order for building materials to support mold growth, a source of water exposure is necessary (e.g., roof/plumbing leaks). Identification and elimination of water moistening building materials is necessary to control mold growth. Materials with increased moisture content *over normal* concentrations may indicate the possible presence of mold growth. CEH staff conducted moisture testing of water-damaged ceiling tiles, GW and carpeting. At the time of the assessment on March 9 2006, all materials tested were found to have low (i.e., normal) moisture content (Table 3). All materials tested on March 14, 2006, with the exception of a ceiling tile outside room 330, were also found to have low (i.e., normal) moisture content (Table 4) at the time of the assessment. The March 14, 2006 assessment occurred after an evening of heavy rainfall. The ceiling tile outside of room 330 was found to have moderate (e.g., borderline) moisture content, most likely indicating a current roof leak.

Please note that moisture content of materials measured is a real-time measurement of the conditions present in the building on March 9 and 14, 2006, respectively. Repeated water damage to porous building materials (e.g., GW, ceiling tiles, and carpeting) can result in microbial growth. The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH,

1989). If not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

The RDC has a history of chronic roof leaks. Water-damaged ceiling tiles, pipe insulation above ceiling tiles and stains on walls were observed in areas throughout the building (Pictures 19 through 21). Water-damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired. Mr. Whitley reported that replacement of ceiling tiles at RDC is ongoing, particularly after wind-driven rain. CEH staff removed ceiling tiles in each of the rooms occupied by MDMH/RCC to examine the plenum above the tile system. Evidence of historic water penetration and leaks from HVAC equipment was observed.

Several portions of the roof have been replaced and or repaired over the years, as was evident from the number of patches observed (Picture 22 and 23). CEH staff observed conditions on the roof and found the surface to be loose, rippled and uneven, creating divots and humps in a large number of areas. Water pooling in these areas followed by subsequent freezing and thawing of water during winter months can lead to roof leaks and related water penetration into the interior of the building. Pooling water can also become stagnant, which can lead to unpleasant odors and microbial growth. In addition, stagnant pools of water can serve as a breeding ground for mosquitoes.

Mr. Whitley also reported that other measures to prevent leaks in the building have been attempted, such as caulking around roof seams and windows, replacing roof flashing (Picture 24), repointing of exterior brickwork, and sealing of roof penetrations around HVAC equipment and utilities (Pictures 25 and 26). Mr. Lane and Ms. McSweeney reported that the Division of Capital Asset Management (DCAM) has committed to capital funds to conduct a comprehensive building envelope study as well as replacement of the roof. In the interim, attempts are

reportedly made to temporarily repair certain areas to prevent water infiltration. The most recent roof repairs were reported to have occurred approximately one month prior to the MDPH assessment.

An examination of the underside of the roof decking in a MDMH/RCC storage room revealed a series of holes for roof drains and hairline cracks in cast cement that have either rust stains or efflorescence (Pictures 27 to 29). Efflorescence is a characteristic sign of water damage to brick and mortar, but it is not mold growth. As moisture penetrates and works its way through mortar and brick, water-soluble compounds in mortar and brick dissolve, creating a solution. As the solution moves to the surface of the mortar or brick, the water evaporates, leaving behind white, powdery mineral deposits. Efflorescence on the underside of a coast stone deck is an indication of chronic water leaks created by the damaged roof membrane.

In addition to chronic roof leaks, Mr. Whitley reported that during the winter of 2005, heating pipes connected to the rooftop AHU (Picture 30) froze, resulting in flooding to the MDMH/RCC offices for approximately three hours. Carpets were reportedly cleaned with an extractor to remove moisture, shampooed several times and dried with floor fans. The flooding also resulted in water-damaged ceiling tiles, pipe insulation, and gypsum wallboard (GW). Although efforts were made to clean and dry carpeting, vinyl coving at the base of walls was not removed. Vinyl coving serves as an impermeable barrier that traps moisture behind it, preventing GW from drying. CEH staff removed the coving in some areas and observed mold growth. Upon closer examination, CEH staff also noted sections of the pipe were not completely insulated and exposed to the elements (Picture 31). Pipes should be fully insulated to prevent the future occurrence of freezing.

In addition to leaks through roof membrane that caused ceiling tile damage to areas on the third floor, CEH staff identified the following likely source of water causing water damage to other building components in a variety of areas in the RDC:

- Water penetrating through the western exterior wall window system (Picture 32);
- Water accumulating behind spandrels of the northeast-facing exterior wall;
- Water penetrating the exhaust system ductwork in the MDMH/RCC offices;
- Water traveling from the roof along the exterior surface of roof drain pipes;
- Water leaking from plumbing systems inside the building; and
- Condensation dripping from chilled water pipes when the HVAC system is operating in the air-conditioning mode during warm weather.

The following describes the aforementioned areas around the building where water related problems exist:

The western exterior wall window system

The western exterior wall of the RDC consists of a glass and metal window frame system that is installed in the cement curtain wall. Window frames and glass appear to be stained with efflorescence (Picture 33), indicating exposure to a solution of water soluble salts resulting from rainwater against the curtain wall cement. This solution is likely alkaline, which can damage window gaskets and caulking, as well as wall sealant used to render expansion joint weathertight. In order to prevent water exposure to windows, builders typically install a drip groove in the stone/cement wall above window frames. As rainwater rolls down the exterior wall, water droplets encounter the drip groove, which directs water to drip downward instead of into the window area itself. No groove edge could be identified for any window in the western exterior wall (Picture 33). In this condition, deterioration of rubber gaskets and caulking could be

accelerated, creating holes through which water may penetrate and moisten interior building components and/or materials stored on windowsills.

Northeast exterior wall

The northeast facing exterior wall consists of a window/stone panel system. Of note are the stone panels, which appear to be constructed from cementitious materials (34a and 35a). The wall panels were mottled with stains, indicating water damage (34b and 35b). CEH staff examined these panels and could not locate weep holes. Weep holes are designed to provide for water drainage.

Exterior wall systems *should* be designed to prevent moisture penetration into the building interior. An exterior wall system should consist of an exterior curtain wall ([Figure 1](#)). Behind the curtain wall is an air space that allows for water to drain downward and for the exterior cladding system to dry. Opposite the exterior wall and across the air space is a continuous, water-resistant material adhered to the back up wall that forms the drainage plane.

The purpose of the drainage plane is to prevent moisture that crosses the air space from penetrating into interior building systems. The plane also directs moisture downwards toward the weep holes. The drainage plane can consist of a number of water-resistant materials, such as tarpaper or, in newer buildings, plastic wraps. The drainage plane should be continuous. Where breaks exist in the drainage plane (e.g., window systems, door systems and univent fresh air intakes), additional materials (e.g. copper flashing) are installed as transitional surfaces to direct water to weep holes. If the drainage plane is discontinuous, missing flashing or lacking air space, rainwater may accumulate inside the wall cavity and lead to moisture penetration into the building.

In order to allow for water to drain from the exterior brick wall system, a series of weep holes is customarily installed at or near the foundation slab/exterior wall system junction ([Figure 1](#)). Weep holes allow for accumulated water to drain from a wall system (Dalzell, 1955). Failure to install weep holes in brickwork will allow water to accumulate within the base of walls, resulting in seepage and possible moistening of interior building components ([Figure 2](#)). As mentioned, the western exterior wall of the RDC lacks weep holes. As a result, water is likely accumulating against these wall panels, resulting in the aforementioned water stain patterns observed by CEH staff.

Exhaust system ductwork in the MDMH/RCC offices

During the course of the assessment on March 14, 2006, newly moistened ceiling tiles were discovered in a MDMH/RCC office located in the southeastern portion of the building. These ceiling tiles were moistened by an active water leak from the corner seams of ductwork for an exhaust system duct above the suspended ceiling (Pictures 36 and 37). The presence of water in exhaust ventilation is unusual and appears to originate from a breach in exhaust vent fans located above this office on the roof.

Exterior surface of roof drain pipes

Pipes in a chaseway located in the ground floor of the RDC were found to be heavily corroded with rust (Picture 38). Water stain patterns on the rust on this pipes suggests water traveling along the exterior of the pipes, which can indicate either a leak from the drain installation in the roof or a leak from a joint of the pipes.

Plumbing systems inside the building.

Another potential source of water damage are leaks from the plumbing drainage system. Above the ceiling in the judge's lobby, CEH staff observed a horizontal run of drain pipe that was pieced together with 5 separate rubber gasket screw clamps within a six foot span (Picture 39). Rubber gasket screw clamps are used to join drain pipes, but are preferred for use in vertical runs of drain pipe because it is less likely that the gasket material would be continuously exposed to liquid. It is preferable that horizontal runs of drain pipes be continuous with as few joints as possible, with the joints installed in a watertight fashion. In the experience of CEH staff, rubber gasket screw clamps are prone to developing opening that allows for liquids and are the escape from the drain pipe joint. This condition may occur due to degradation of the rubber of the clamp, degradation of pipe material or shifting of pipes due to building settling space through which air and liquid may flow.

Condensation from chilled water pipes

A significant number of water-damaged ceiling tiles were located beneath pipes that supply chilled water for the HVAC system components. Missing and damaged insulation was observed in some areas above the ceiling tile system (Picture 40). When warm, moist air passes over a surface that is colder than the air, water condensation can collect on the cold surface. Over time, water droplets can form, which can then drip from a suspended surface. For this reason, HVAC systems pipes that provide chilled water are insulated. Pipes with either water-damaged or missing insulation are prone to generating condensation, which in turn beads into water droplets and fall downward to wet ceiling tiles.

All of the conditions listed above provide for water to moisten building components and likely cause mold growth. While it appears that a program to replace water-damaged ceiling tiles has been instituted at the RDC, repair of the roof and the other identified water sources is necessary to improve the indoor environment of this building.

Plants were noted in several areas (Tables 1 and 2); a few were noted to be in containers of standing water in room 317. As previously mentioned, mold growth was confirmed from tape samples from a drip pan of a plant in room 316 (Table 5) and from newspapers in a first floor work station (Picture 41/Table 6). Plants were also observed on circular pieces of carpeting which were specifically cut to fit into the underside of waste baskets (Picture 42). Plants should be properly maintained and be equipped with drip pans made of a non-porous material. Drip pans should be cleaned and inspected periodically to prevent mold growth. Plants should be located away from ventilation sources to prevent aerosolization of dirt, pollen or mold.

Other IAQ Evaluations

A number of other conditions that can affect indoor air quality were noted during the assessment. Several occupants reported a black particulate material that falls onto their work spaces from ceiling-mounted supply diffusers. In several cases occupants have sealed their vents to prevent such occurrences (Picture 43). Sealed vents limit air exchange and create an imbalance in the system, where air can be forced out in adjacent areas. This can make it difficult to maintain thermal comfort throughout the building.

CEH staff inspected AHUs in the penthouse and found that three of the four units had holes in the sheet-metal housing (Pictures 44 and 45). This is important to note because the location of the breaches were *post-filter*. As air is forced through the AHU it becomes

depressurized, and can draw in unfiltered air, dirt, dust and debris into the unit through these breaches, which can then be distributed throughout the building via the ventilation system.

A number of supply and return vents had accumulated dust. If return vents are not functioning, backdrafting can occur, which can re-aerosolize dust particles. Dust particles can also be aerosolized when the supply system is activated. In several areas, items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored provides a source for dusts to accumulate. These items (e.g., papers, folders, boxes) make it difficult for custodial staff to clean. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up.

A gas-powered snow blower and gasoline container were being stored in the ground floor hallway, near office space (Picture 46). Odors and off-gassing of VOCs from gasoline can have an adverse effect on indoor air quality. In addition the storage of these items indoors can pose a fire hazard.

Finally, occupants expressed concerns regarding carpet cleaning in several areas throughout the building. The Institute of Inspection, Cleaning and Restoration Certification (IICRC), recommends that carpeting be cleaned annually or semi-annually in high traffic areas (IICRC, 2005).

Conclusions/Recommendations

The conditions noted at the RDC raise a number of indoor air quality issues. Chronic water infiltration through the building envelope, roof leaks in combination with plumbing/drainage issues and the large volume of water from the flooding which occurred due to the frozen rooftop AHU pipes over the winter of 2005, have created conditions that have

subsequently led to mold growth on porous building materials and items stored in the building. Interior renovations (e.g., replacement of carpeting and ceiling tiles and physical removal of mold-colonized GW) will serve to remove any actively growing mold colonies. Plans to replace the roof and building envelope repairs will serve to eliminate water infiltration.

In view of the findings at the time of the assessment, the conditions present within the MDMH/RCC and RDC require three distinct remediation activities: A) removal of water-damaged/mold colonized materials, B) remediation to reduce/prevent water sources from entering the building, and C) general indoor air quality recommendations.

A) Removal of Water-damaged/Mold Colonized Materials

1. Ensure that the general mechanical ventilation system is deactivated and/or sealed (i.e., supply and return vents) in areas about to undergo remediation.
2. Discard/replace water-damaged/mold colonized porous materials (e.g., ceiling tiles, GW, pipe insulation). This measure will remove actively growing mold colonies that may be present. This work should be conducted at a time when occupants are not present in the area. Contain the area where contaminated materials are removed to prevent the spread of dust and mold spores. Once work is completed, ensure that the area is thoroughly cleaned and disinfected with an appropriate antimicrobial. Renovation generated dust and particulates in carpeted areas should be vacuumed with a HEPA filtered vacuum cleaner.
3. Conduct remediation activities in a manner consistent with recommendations in “Mold Remediation in Schools and Commercial Buildings” published by the US Environmental

Protection Agency (US EPA, 2001). This document can be downloaded from the US EPA website at: http://www.epa.gov/iaq/molds/mold_remediation.html.

4. Examine the areas above and behind these areas for water-damaged building materials and mold growth. If additional water-damaged building materials are colonized with microbial growth, remove. Disinfect areas of water leaks/microbial growth with an appropriate antimicrobial.
5. Discard porous materials (e.g., boxes, papers, files) that are deemed unworthy of preservation, restoration or transfer to another media (e.g., microfiche or computer scanning). Where stored materials such as medical records are to be preserved, restored or otherwise handled, an evaluation should be conducted by a professional book/records conservator. The preservation/restoration process can be rather expensive and may be considered for conservation of irreplaceable documents that are colonized with mold. Due to cost of conservation, disposal or replacement of moldy materials may be the most economically feasible option.
6. Re-wrap water-damaged pipe insulation above ceiling tiles.
7. Re-wrap exposed pipe insulation for rooftop AHU to prevent damage and potential flooding.
8. Repair/replace damaged insulation around ductwork in room 314 (Picture 40), as well as other areas to prevent condensation.
9. Use local exhaust ventilation and isolation techniques to control remediation pollutants. Precautions should be taken to avoid the re-entrainment of these materials into the building.

10. Disinfect non-porous surfaces (e.g., floors, walls, metal) with a one-in-ten bleach solution.
11. Establish communications between all parties involved with remediation efforts, including building occupants, to prevent potential IAQ problems.

B) Water Infiltration Recommendations

1. Continue with plans to replace roof and conduct building envelope survey. Make any needed repairs to building envelope to prevent water infiltration and subsequent water damage.
2. Continue to monitor for active leaks roof leaks. Building occupants should notify the Court Facilities Bureau if leaks are observed for prompt action.
3. Continue working with roofing contractor in making roof repairs/patches as needed to prevent further water penetration.
4. Refrain from storing porous materials in areas of current and/or chronic leaks.
5. Ensure that measures to dry building materials (e.g., fans and/or heating) are taken for future flooding/heavy water damage are made in accordance with US EPA and ACGIH recommendations (e.g., within 24 to 48 hrs.) to prevent mold growth. In addition, vinyl coving should be removed to ensure complete drying of the base of walls.

C) General Air Quality Recommendations

1. Seal holes in AHUs.
2. Clean/change filters for air handling equipment as per the manufactures' instructions or more frequently if needed. Prior to activation, vacuum interior of units to prevent the aerosolization of dirt, dust and particulates.

3. Contact an HVAC engineering firm for an assessment of ventilation systems building-wide (e.g., controls, air intake louvers, thermostats and ductwork/insulation).
4. Replace missing/damaged ceiling tiles in order to maintain the integrity of the return plenum.
5. Consider balancing mechanical ventilation systems every 5 years, as recommended by ventilation industrial standards (SMACNA, 1994).
6. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
7. Ensure all plants are equipped with drip pans that are made of a *non-porous* material. Examine drip pans for mold growth and disinfect areas of water leaks with an appropriate antimicrobial where necessary. Move plants away from ventilation sources. Consider reducing plants in some areas.
8. Consider developing a written notification system for building occupants to report indoor air quality/comfort issues. Have these concerns relayed to the maintenance department/building management in a manner to allow for a timely remediation of the problem.
9. Store gas-powered equipment and related equipment outside the building.
10. Consider cleaning carpeting annually or semi-annually in soiled/high traffic areas as per the recommendations of the Institute of Inspection, Cleaning and Restoration

Certification (IICRC). Copies of the IICRC fact sheet can be downloaded at:

http://www.cleancareseminars.com/carpet_cleaning_faq4.htm (IICRC, 2005)

11. Refer to resource manual and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings; these materials are located on the MDPH's website: <http://www.state.ma.us/dph/beh/iaq/iaqhome.htm>.

References

ACGIH. 1989. Guidelines for the Assessment of Bioaerosols in the Indoor Environment. American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

BOCA. 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL. Section M-308.1.1.

Dalzell, J.R. 1955. *Simplified Masonry Planning and Building*. McGraw-Hill Book Company, Inc. New York, NY.

IICRC. 2005. Carpet Cleaning FAQ 4 Institute of Inspection, Cleaning and Restoration Certification. Institute of Inspection Cleaning and Restoration, Vancouver, WA.

MDLWD. 2000. Indoor Air Quality (IAQ) Survey 00S-0158, Roxbury District Court, 85 Warren Street, Roxbury, MA. Department of Labor and Workforce Development, Division of Occupational Safety, West Newton, MA. Dated June 6, 2000.

MDLWD. 2002. Report Re: Water Leaks in Roxbury District Court Building 02S-0373. Roxbury District Court, 85 Warren Street, Roxbury, MA. Department of Labor and Workforce Development, Division of Occupational Safety, West Newton, MA. Dated July 16, 2002.

MDLWD. 2004. Indoor Air Quality (IAQ) Survey 05S0070, Roxbury District Court, 85 Warren Street, Roxbury, MA. Department of Labor and Workforce Development, Division of Occupational Safety, West Newton, MA. Dated October 25, 2004.

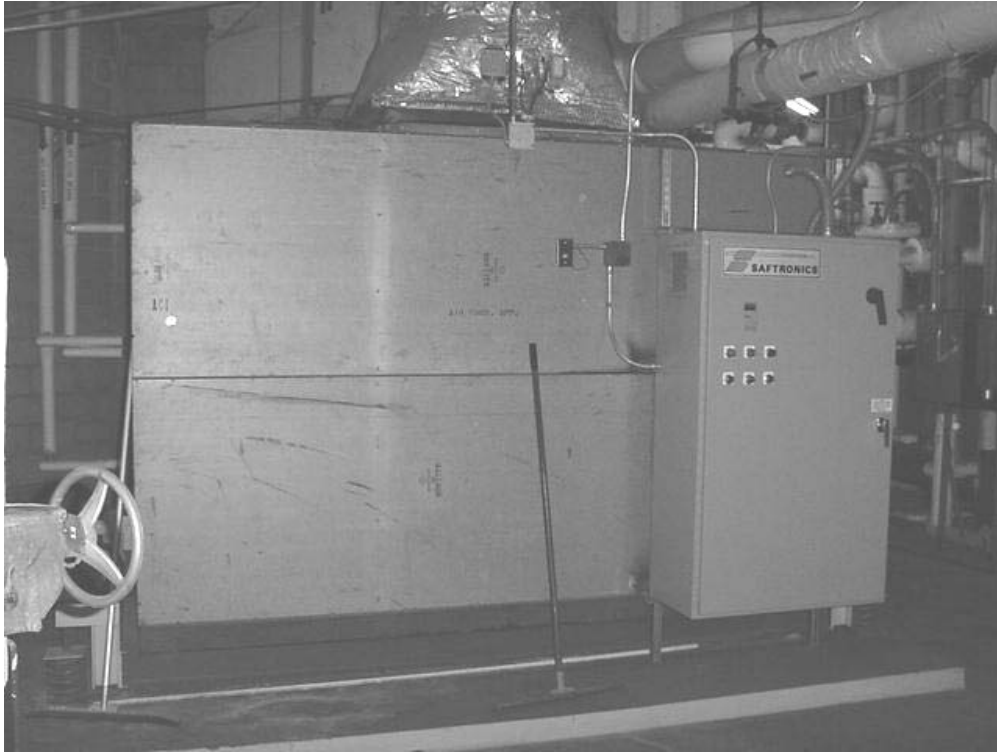
OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

US EPA. 2001. Mold Remediation in Schools and Commercial Buildings. US Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division, Washington, DC. EPA 402-K-01-001. March 2001.

Picture 1



AHU (one of four) Located in Penthouse

Picture 2



Fresh Air Intakes for AHUs

Picture 3



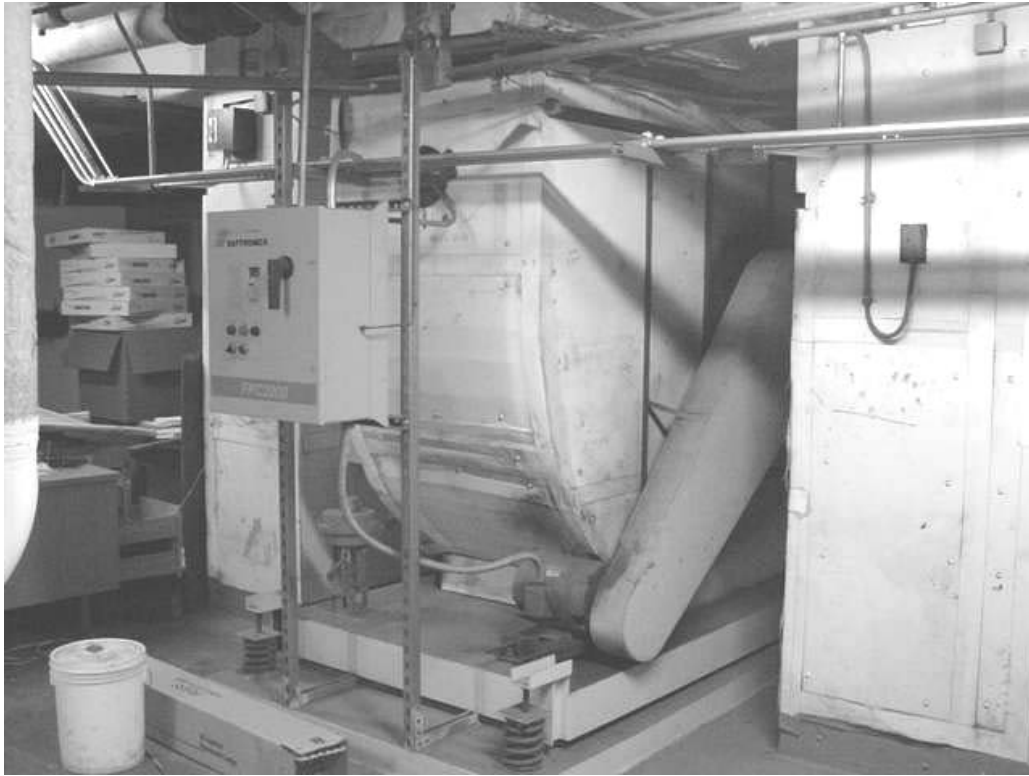
Ceiling-Mounted Air Diffuser

Picture 4



Ceiling-Mounted Exhaust Vent

Picture 5



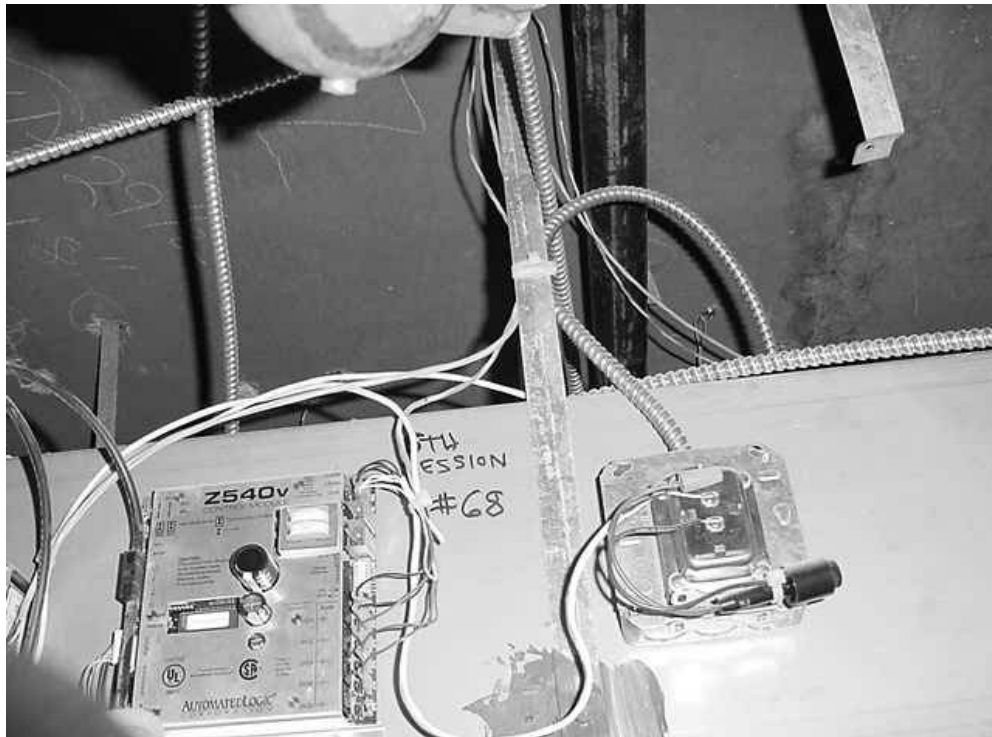
Exhaust Fan Booster Units Located in Penthouse

Picture 6



Rooftop AHU for 1993 addition

Picture 7



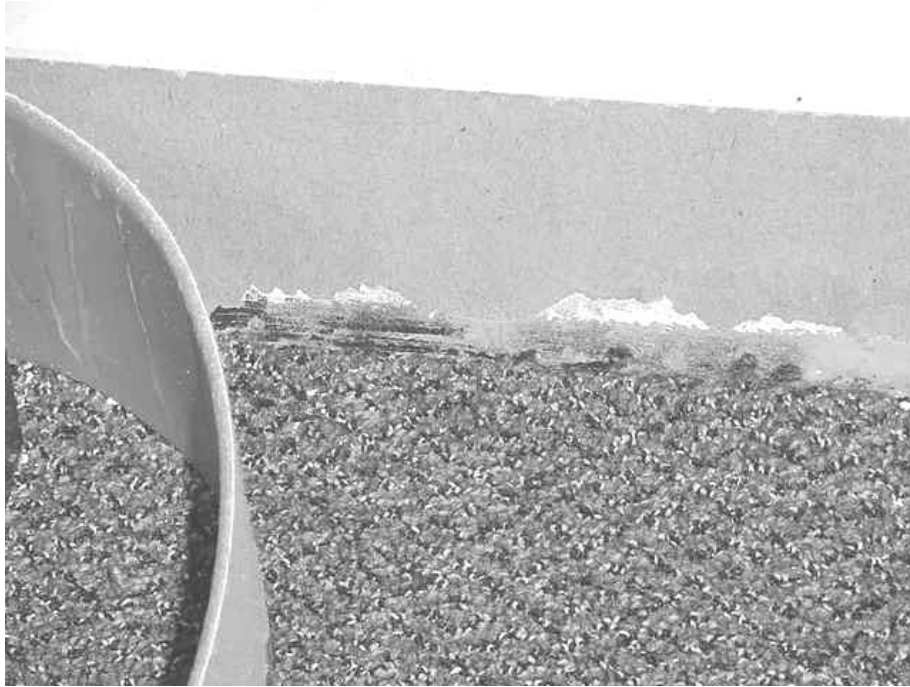
VAV Box controls

Picture 8



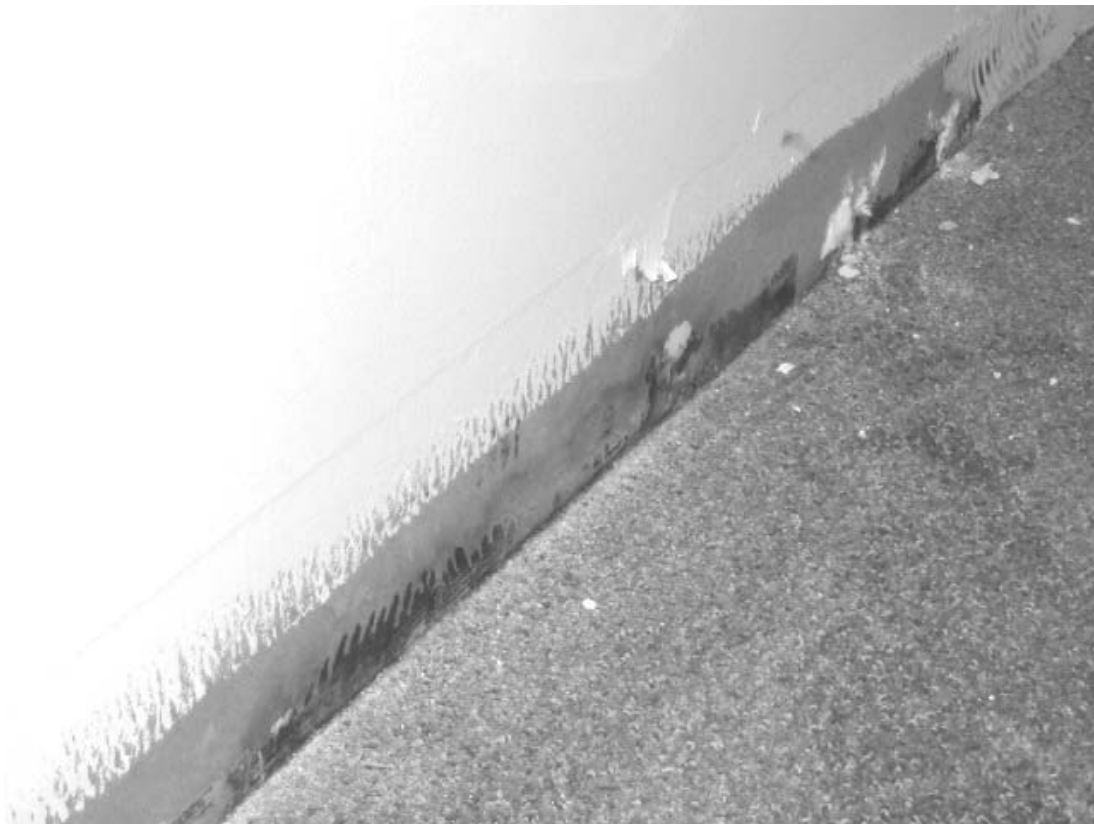
Vinyl Coving Removed Beneath Area of Flooding in Room 314

Picture 9



Visible Mold Growth (as Indicated by Dark Stains at Base of Wall) on Surface of Gypsum Wallboard behind Vinyl Coving in Room 314

Picture 10



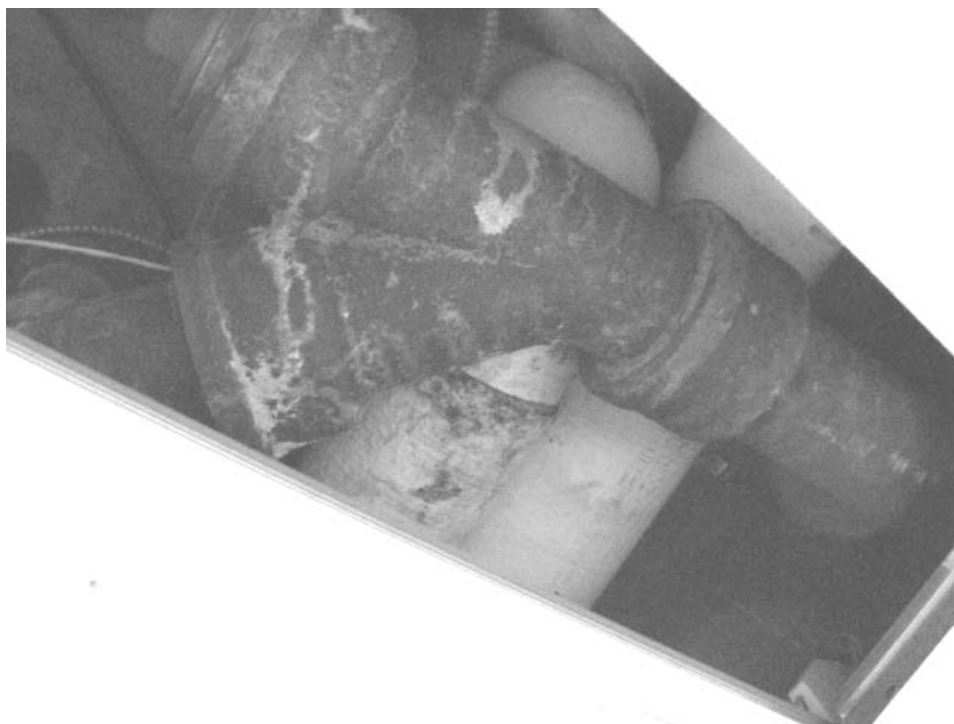
Mold Colonized GW in Store Room as Indicated by Dark Staining along Base

Picture 11



Visible Mold Growth (as Indicated by Dark Stains) on Painted Surface of Gypsum Wallboard in Central Storage Room

Picture 12



Water Damaged/Mold Colonized Pipe Insulation outside of Room 330

Picture 13



Water Damaged/Mold Colonized Ceiling Tile in the DA's Support Area

Picture 14



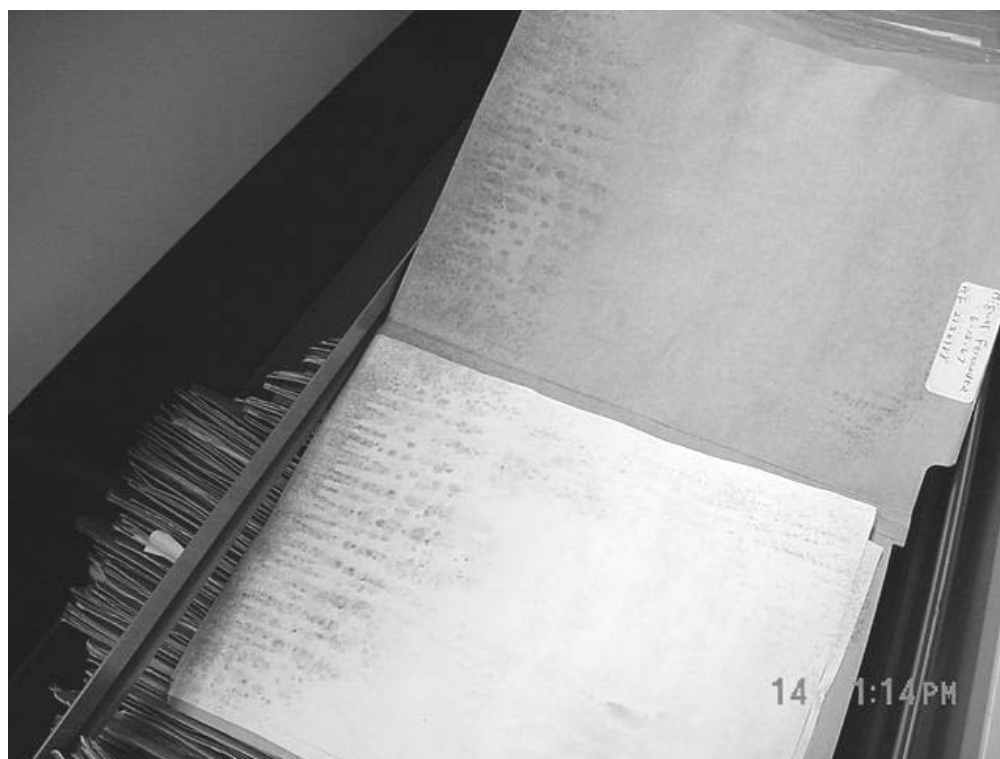
Water Damaged/Mold Colonized Ceiling Tile in Clerk's Area (near Coat Rack) (Note Downward pattern of rust, indicating water leak from above floors)

Picture 15



Water Damaged/Mold Colonized Books in Room 165

Picture 16



Water Damaged/Mold Colonized Files in Storeroom 112

Picture 17



Water Damaged/Mold Colonized Newspapers under Plants in First Floor Work Station near Fire Control Panel

Picture 18



Bottom of Wicker Basket Containing Plant and Plate Serving as a Drip Pan on Windowsill in Room 316

Picture 19



Water Damaged/Missing Ceiling Tiles in Records Storeroom

Picture 20



Water Damaged Ceiling Tiles and Gypsum Wallboard in Room 314, Note Light Areas Indicate Repairs Made to Water Damaged Materials

Picture 21



Water Damaged Ceiling Tiles in Room 316

Picture 22



Uneven Roof Surface, Note Patches on Seams Indicated by Dark Material on Roof Deck

Picture 23



Patches Indicated by Dark Material on Roof Deck

Picture 24



Repairs Made to Roof Flashing

Picture 25



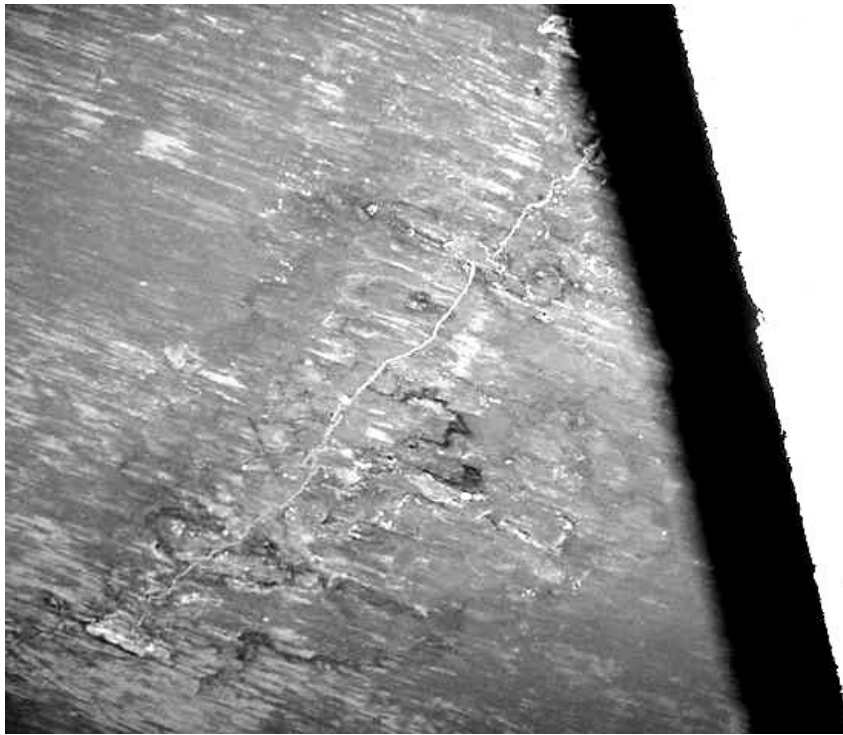
Seems around HVAC Equipment Sealed

Picture 26



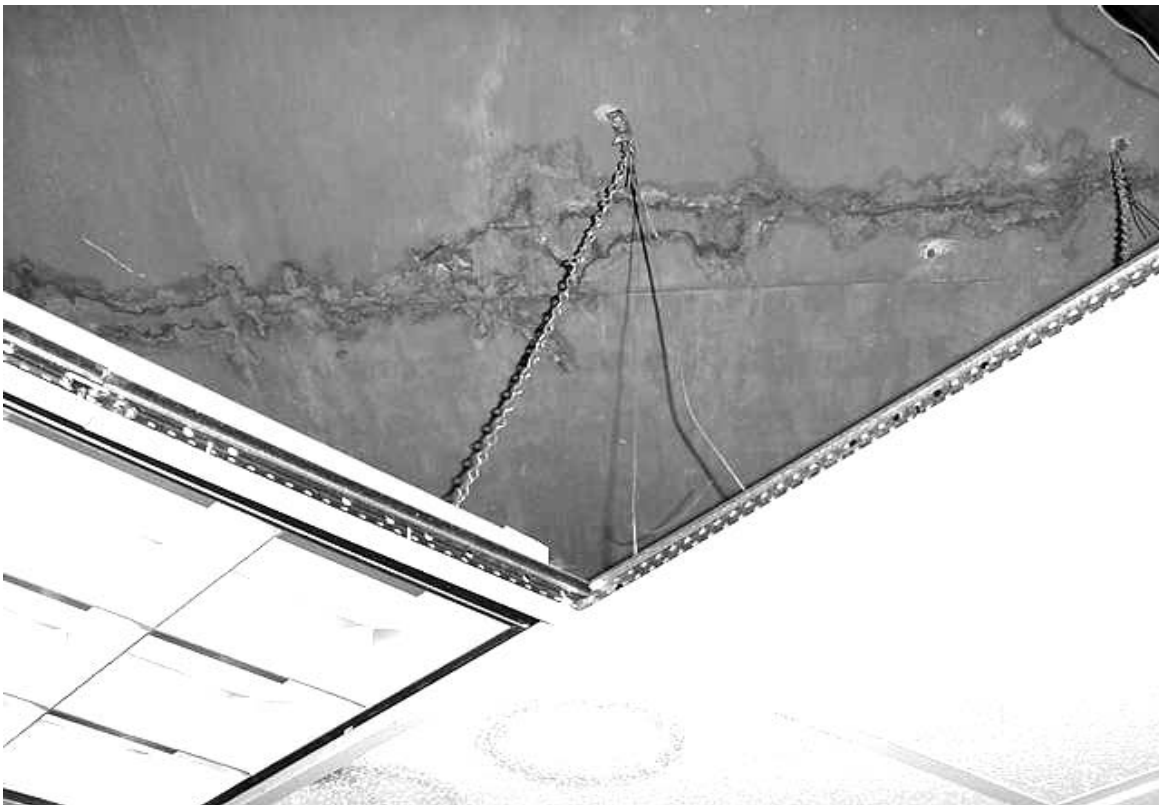
Penetrations around Utilities Sealed

Picture 27



Rust Stains and efflorescence, roof deck above MDMH store room

Picture 28



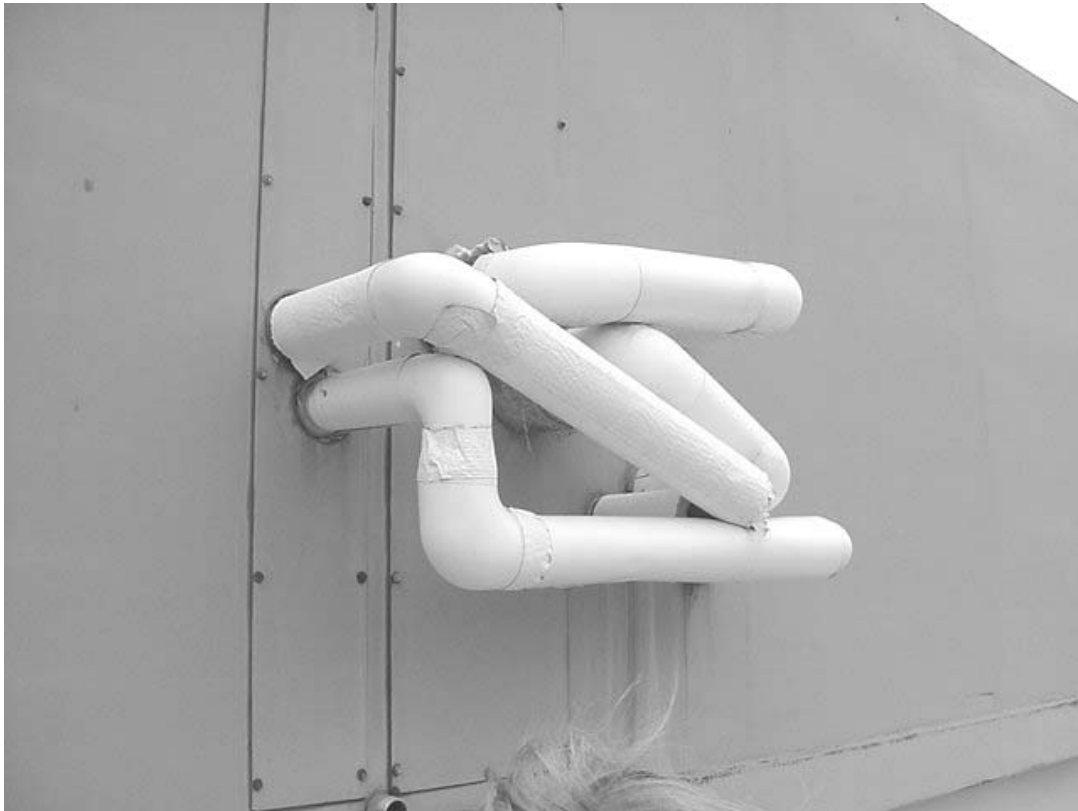
Rust Stains and efflorescence, roof deck above MDMH store room

Picture 29



Water damage to roof decking around roof drain, roof deck above MDMH store room, Note Corrosion on joint held in place by rubber gasket screw clamp (see arrow)

Picture 30



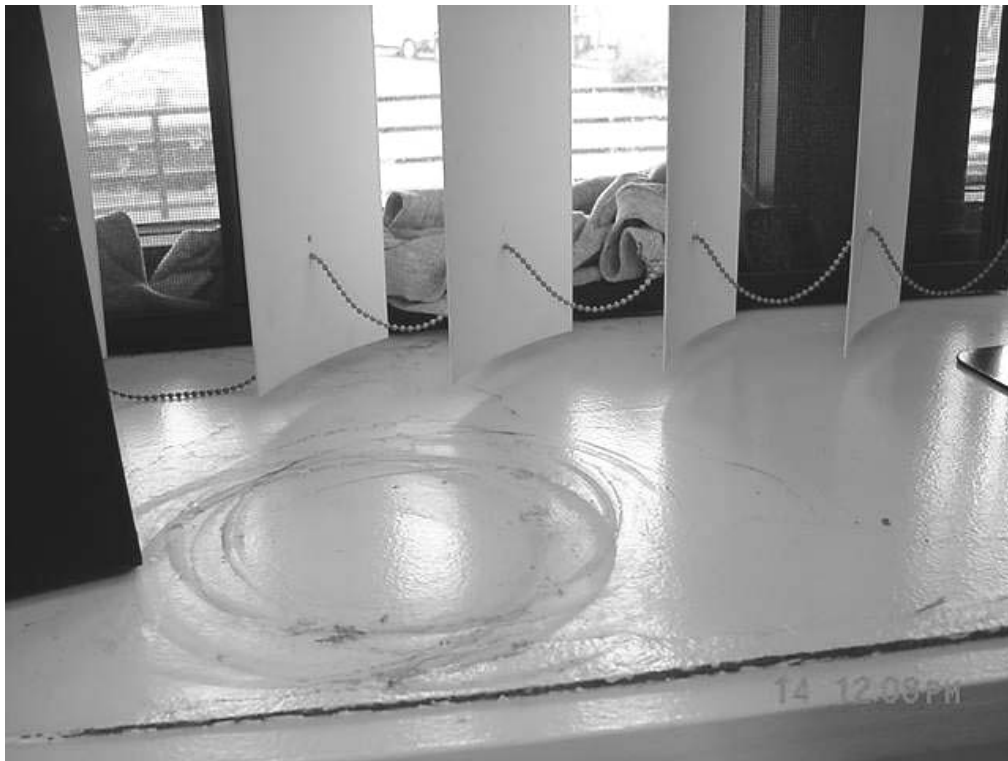
AHU Heating Pipes That Froze over the winter of 2005

Picture 31



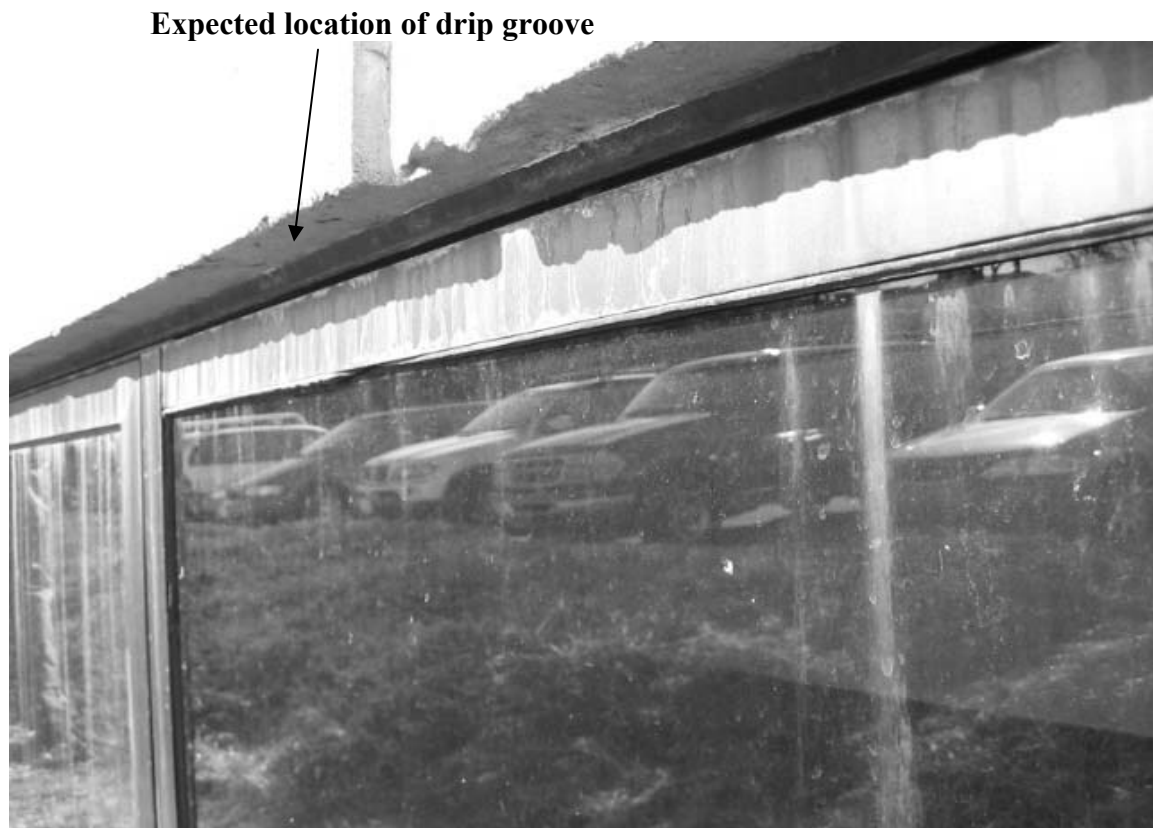
Close-Up of Exposed AHU Heating Pipes Shown in Preceding Picture

Picture 32



Water Damaged Wooden Windowsill on First Floor (Rear), Note Cloth Stuffed Between Window Pane to Absorb Moisture

Picture 33



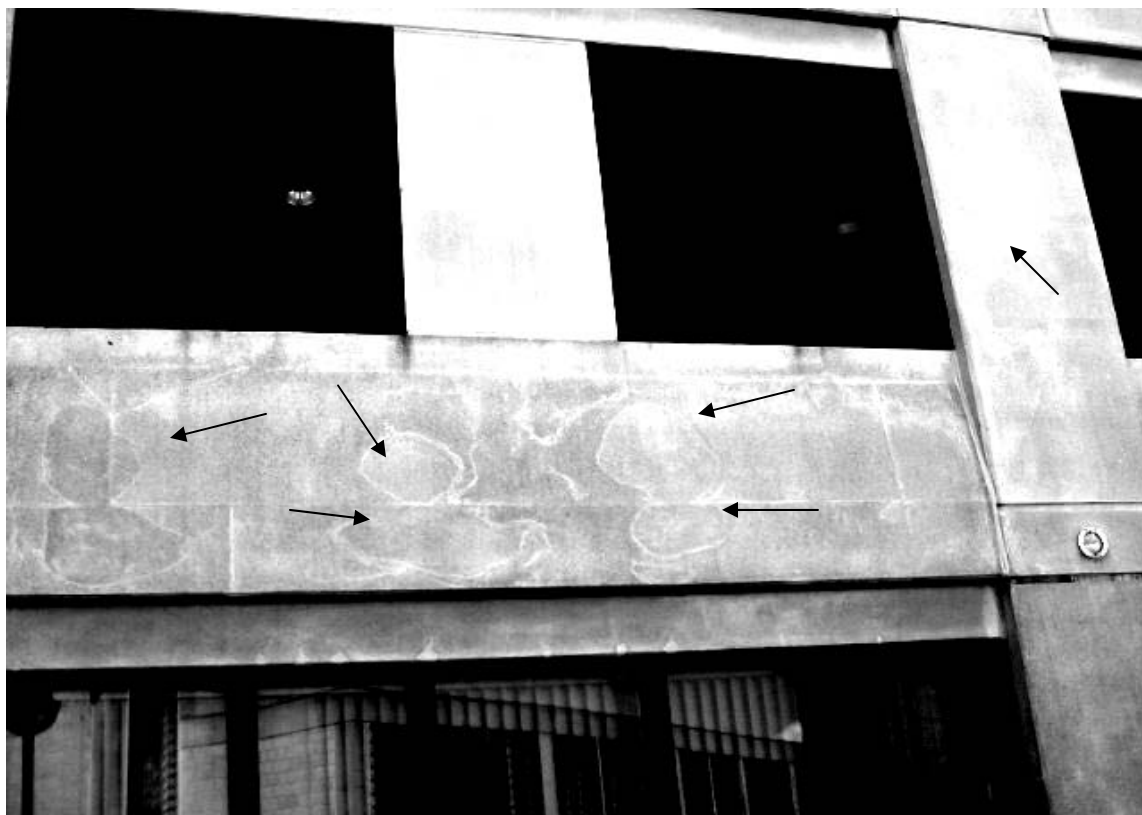
Efflorescence staining West Wall Window system, no lack of drip groove above window

Picture 34a



Exterior Wall Panel Northeast wall

Picture 34b



Picture 33a with contrast altered, revealing water stain patterns on exterior wall panels (Arrows)

Picture 35a



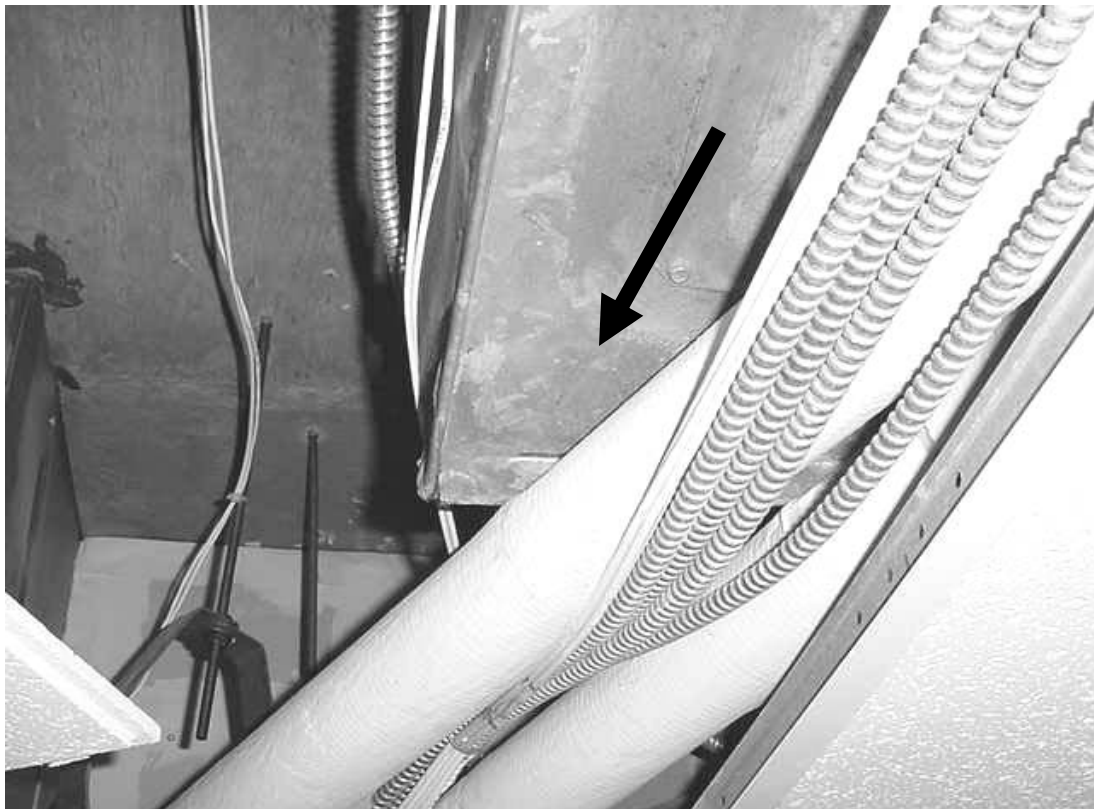
Exterior Wall Panel Northeast wall

Picture 35b



Picture 34a with contrast altered, revealing water stain patterns on exterior wall panels (Arrows)

Picture 36



Exhaust vent ductwork leak water, note water stains at corner (Arrow)

Picture 37



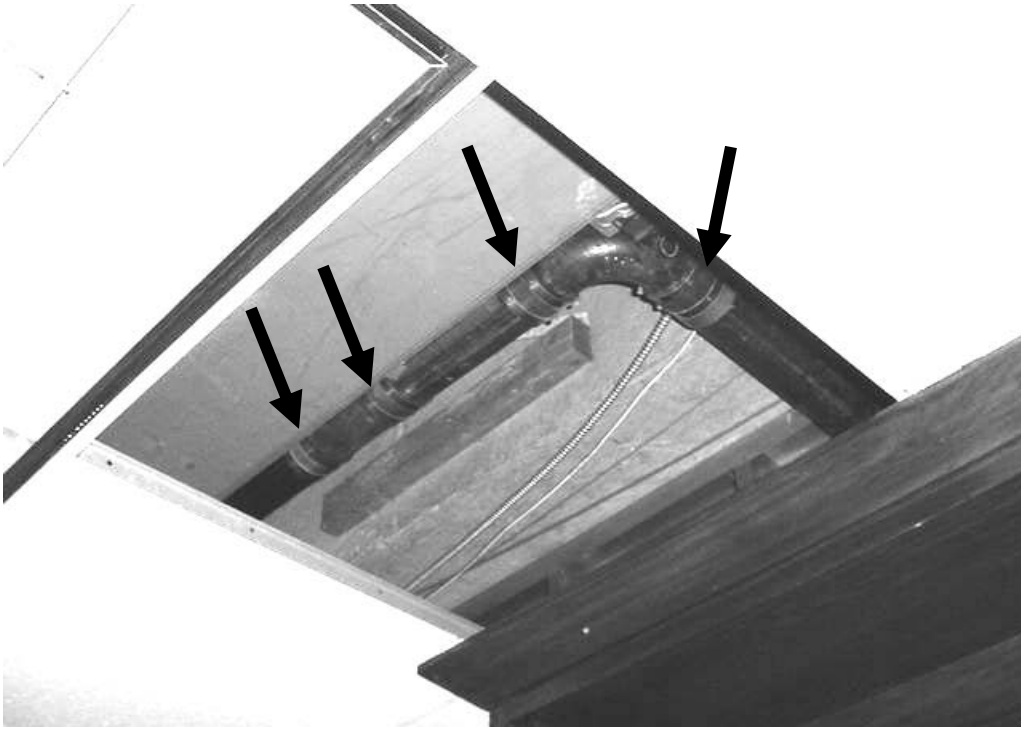
Exhaust vent ductwork leak water, other seam of duct leaking water (Arrow)

Picture 38



Rusty pipes in chaseway

Picture 39



Rubber Gasket screw clamps on single pipe (Arrow)

Picture 40



Missing Damaged Duct Insulation above Ceiling Tile System in Room 314

Picture 41



Plants on paper print material

Picture 42



Plant on carpet cutout

Picture 43



Sealed supply vent

Picture 44



Hole in Penthouse AHU Casing (Post Filter)

Picture 45



Hole in AHU Casing in Picture 40 with Dollar Bill held on casing by draw of air into Unit to Illustrate Entrainment

Picture 46



Snow Blower and Gas Can Stored inside Ground Floor Hallway

TABLE 1

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 9, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Background	398	37	70					Moderate to heavy traffic, wind SSE 5-10 mph
314	595	76	20	0	Y	Y	Y	WD building materials (GW, carpet, pipe insulation, CTs)
Storage Room	560	77	22	3	N	Y	Y	Temporary storage of office space, WD building materials (GW, carpet, pipe insulation, CTs)
313	519	78	19	0	N	Y	Y	WD building materials (GW, carpet, pipe insulation, CTs)
316	559	74	23	0	Y	Y	Y	2 WD CTs near windows, plants
317	561	73	22	0	Y	Y	Y	WD building materials (GW, carpet, pipe insulation, CTs), plants
304	603	73	24	0	Y	Y	Y	WD building materials (GW, carpet, pipe insulation, CTs)

- ppm = parts per million parts of air,
- CT = ceiling tile, WD = water damage, GW = gypsum wallboard

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Background	402	47	89					Moderate to heavy traffic, light rain, west winds 10-15 mph
320	677	71	50	4	N	Y	Y	2 MT
Court Clinic reception	690	73	49	1	N	Y	Y	Plants, water cooler on carpet
DA Reception	837	74	50	5	N	Y	Y	Dusty supply vents
DA Support Staff	716	75	47	1	N	Y	Y	1-CT
334	703	75	45	0	N	Y	Y	Record storage, 1 CT, plants
332	650	76	46	0	N	Y	Y	Dusty supply vent
330	678	76	47	2	N	Y	Y	Poor airflow complaints, DO, CT in hallway outside 330, WD pipe insulation above CT
Court Officers Hallway	705	74	44	0	N	N	N	6 CT/2 MT
Men's Locker Room	645	74	45	0	N	N	Y	3 CT, 1 MT-plastic sheeting above CTs

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
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Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
1 st Session Courtroom	630	74	46	20	Y	Y	Y	Stained acoustic fabric-dust deposition
3 rd Session Courtroom	714	74	48	7	N	Y	Y	
5 th Session Courtroom	517	75	45	0	N	Y	Y	
6 th Session Courtroom	701	75	48	30+	Y	Y	Y	
2 nd Floor Lobby-Hall	577	74	46	20+	N	N	N	
Judges Lobby	479	75	45	4	N	Y	Y	Plants
Hallway 1 st Session					Y	Y	Y	2 CT, window open
225	551	73	43	0	Y	Y	Y	Plants
224	558	73	44	0	Y	Y	Y	1 CT
223	583	75	44	1	Y	Y	Y	3 CT, drain pipe, plants
221	513	74	44	0	Y	Y	Y	CT

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
 600 - 800 ppm = acceptable
 > 800 ppm = indicative of ventilation problems

Temperature - 70 - 78 °F

Relative Humidity - 40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Conference Area	516	75	44	0	N	Y	Y	
220	510	73	40	0	N	Y	Y	
218	584	74	40	0	N	Y	Y	4 CT
217	489	74	43	0	N	Y	Y	4 MT, plants
Cell Block Command Ctr.	676	72	46	2	N	Y	N	Clogged floor drains, periodic sewer gas odor complaints
Criminal Dept Waiting Area	772	74	53	11	N	Y	Y	2 CT
166	648	74	45	0	Y	Y	Y	Plants
165	712	75	46	2	Y	Y	Y	Plant, complaints of poor airflow, WD windowsill, WD books-moldy, towels used to stop drafts/leaks in windows
162 C	702	75	45	2	Y	Y	Y	Plants-in standing water-basket black (possible mold growth)
162 B	561	75	42	0	Y	Y	Y	Plants, broken window pane, WD window sill

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
162 A	532	70	47	0	Y	Y	Y	WD carpet, reports of reoccurring plumbing leaks damaging carpet, 2 CT, damaged window caulking
158 Lunch Room	780	73	53	7	Y	Y	Y	3 CT
Hallway (outside 158)					N	N	N	Gas powered snow blower & gas can
152	825	73	50	2	Y	Y	Y	Complaints of black debris from vent system, 1 CT
151	975	74	47	1	Y	Y	Y	Saw dust on shelves near windows
150 Storage	685	73	43	0	N	Y	Y	Dust deposition on CTs near diffuser, MT
147	666	74	46	0	N	Y	Y	Supply vent sealed-reportedly to prevent debris from falling on desk, dust deposition on CTs
143	640	75	45	1	N	Y	Y	1 CT
142	638	75	45	0	Y	Y	Y	

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

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	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
136	964	75	45	0	N	Y	Y	Little airflow detected from supply vent
134	718	75	44	0	Y	Y	Y	3 MT, 1 CT
129	729	73	44	1	Y	Y	Y	Plant, 1 CT in hallway
123	737	73	44	1	Y	Y	Y	1 CT, plant
113	760	73	44	1	Y	Y	Y	Water penetration reported through window frames, vent sealed-debris
112	652	74	44	0	N	Y	Y	Water damaged files/papers-visible mold growth
115	711	74	45	1	N	Y	Y	5 CT, 1 MT, fiberglass insulation
320	818	71	54	0		Y	Y	
335	723	74	54	0	Y	Y	Y	
Interns Area (near photocopier)	700	74	50	0	Y	Y	Y	Photocopier, water cooler on carpet

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

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	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Desk 5 interns	692	74	48	0	Y	Y	Y	Window open
Interns near stairs	672	74	47	0	Y	Y	Y	Window open, damaged window caulking
328	632	75	47	0	N	Y	N	Photo copier, refrigerator on carpet
329	656	75	45	0	N	Y	N	Painted CT, bubbled carpet
Breakroom	571	75	46	0	N	Y	Y	WD GW, water cooler and fridge on carpet, CT and carpet in hallway
Cell Block Conf Room	613	74	43	0	N	Y	N	
Clerks Area Front Left (near clock)	626	76	45	2	N	Y	Y	
Clerks Front Right	601	76	44	3	N	Y	Y	Cleaners
Clerks (near coat rack)	601	76	44	0	N	Y	Y	CTs, MTs, hissing noise above CTs
Clerks (cash office wall)	558	78	45	1	N	Y	Y	Personal fan, plants

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Clerks (rear near microwave)	562	76	44	1	N	Y	Y	Plants, dirt, CT
Clerks (center aisle near state troopers desk)	563	76	44	2	N	Y	Y	Plants, personal fan
Clerks (Seymour cube near exit)	625	77	43	1	N	Y	Y	Plants
Custodial Room B	686	71	53	1	Y	Y	Y	Plants, 2 CT
155 Build Supt	731	72	50	1	Y	Y	Y	1 MT, 2 CT
Mail Room	661	73	49	0	N	Y	N	
Old Equipment Room	686	76	42	0	N	Y	N	
149	686	76	42	0	N	Y	Y	Plants
148	649	76	42	2	N	Y	Y	Plants
145	679	76	43	0	N	Y	Y	Dry erase markers, ajar CT

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
144	631	76	42	2	N	Y	Y	Plants
132	640	75	41	0	N	Y	Y	
131 records storage	640	74	41	0	N	Y	Y	Opens to clerks office
128	655	74	42	0	Y	Y	Y	WD box, CT
125	643	73	44	1	N	Y	Y	1 CT
124	664	72	44	1	Y	Y	Y	Dry erase markers, 1 CT
Near fire alarm control door	707	72	45	0	N	Y	Y	Plants, CT, WD-painting
114	544	71	44	0	Y	Y	Y	CT, peeling wall paint, plants
111	541	72	44	0	Y	Y	Y	3 CT, plants
Clerical (near restraint order area)	639	74	42	0	N	Y	Y	Photocopier

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Roxbury District Court, Boston, MA – March 14, 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Clerical	597	74	42	0	N	Y	Y	Water cooler on carpet, plants
Cash Office	652	75	41	2	N	Y	Y	photocopier

- ppm = parts per million parts of air, WD = water damage
- CT = water damaged ceiling tile, MT = missing ceiling tile

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 3
Relative Humidity and Moisture Test Results
DMH Court Clinic, Roxbury District Court
March 9, 2006

Location	Relative Humidity (%)	Material/Comments	Moisture Measurement (e.g., Low = Normal)
Outdoors	70	Mostly cloudy, wind SSE 5-10 mph	-
314	20	Pipe insulation above ceiling tiles	low
314	20	Gypsum Wallboard	No – Low So - Low East – Low West – Low
314	20	Carpeting	Low
313	19	Carpeting	No – Low So - Low East – Low West – Low
313	21	Ceiling tiles	Low
313	21	Gypsum Wallboard	No – Low So - Low East – Low West – Low
313	21	Pipe insulation	Low
316	23	Gypsum Wallboard	No – Low So - Low East – Low West – Low
316	23	Ceiling tile near window	Low
316	23	Carpeting	No – Low So - Low East – Low West – Low
317	22	Gypsum Wallboard	No – Low So - Low East – Low West – Low
317	22	Carpeting	No – Low So - Low East – Low West – Low
317	22	Ceiling Tiles	Low
304	24	Ceiling Tiles	Low
304	24	Carpeting	No – Low So - Low East – Low West – Low
304	24	Gypsum Wallboard	No – Low So - Low East – Low West – Low

Note: Dew point on this date was: 27° F

TABLE 4

**Relative Humidity and Moisture Test Results
Roxbury District Court
March 14, 2006**

Location	Relative Humidity (%)	Material/Comments	Moisture Measurement (e.g., Low = Normal)
Outdoors	89	Light rain, following evening of wind and heavy rain	-
320	50	Carpeting	No - Low So - Low East - Low West - Low
DA Support Staff	47	Water Damaged Ceiling Tile	Low
334	45	Water Damaged Ceiling Tile	Low
330	47	Water Damaged Ceiling Tile (current leak)	Moderate
Court Officers Hallway	44	Water Damaged Ceiling Tile	Low
Men's Locker Room	45	Water Damaged Ceiling Tiles	Low
165	46	Water Damaged Wooden Windowsill	Low
162 A	47	Gypsum Wallboard below Windows	Low
Clerks Area (Rear/Right)	44	Water Damaged Ceiling Tiles/below Ceiling Leak	Low
Clerks Area (Rear/Right)	44	Gypsum Wallboard/below Ceiling Leak	Low
Clerks Area (Rear/Right)	44	Carpeting/below Ceiling Leak	Low
128	42	Water Damaged Ceiling Tiles	Low
128	42	Carpeting	No - Low So - Low East - Low West - Low
128	42	Water Damaged Boxes	Low
113	44	Gypsum Wallboard/Interior Wall	Low
113	44	Carpeting near Interior Wall	Low

Note: Dew point on this date was: 42° F

TABLE 5
Results of Tape and Bulk Samples, Department of Mental Health Offices, Roxbury District Court
Samples Taken March 9, 2006

Location	Sample Media	Location in Room	Fungal Growth
Room 304	Tape	West/Northwest wall, behind coving	None
	Tape	Wall, 3 feet above floor (comparison)	None
	Bulk	Spray-on Insulation above ceiling tile	None
Room 313	Tape	Ceiling tile above lateral files	None
	Bulk	Insulation above ceiling	None
Room 314	Tape	Dry wall, north corner behind coving	<i>Chaetomium globosum</i> <i>Penicillium sp.</i> <i>Stachybotrys chartarum</i>
	Tape	North corner on wall, 8 inches above floor and coving	None
	Tape	Ceiling tile next to west/northwest wall	None
	Tape	Water damaged pipe insulation	<i>Acremonium sp.</i>
	Tape	Surface of supply vent	None
	Tape	Surface of return vent	None
	Tape	South wall, 8 inches above floor (comparison sample)	None
	Bulk	Dry wall North corner behind vinyl coving	<i>Acremonium sp.</i> <i>Chaetomium globosum</i> <i>Stachybotrys chartarum</i>
	Bulk	Ceiling tile next to West/Northwest wall	None
	Bulk	Dry wall Northwest corner	<i>Stachybotrys chartarum</i>
Room 316	Tape	Plant drip pan on windowsill below straw basket	<i>Penicillium/Aspergillus-like</i>
	Tape	Dry wall behind coving on northwest corner	None
	Tape	Base of potted plant on floor	None
	Tape	Surface of supply vent	None

TABLE 5
Results of Tape and Bulk Samples, Department of Mental Health Offices, Roxbury District Court
Samples Taken March 9, 2006

	Tape	Surface of return vent	None
	Tape	Wall next to table (comparison sample)	None
	Bulk	Ceiling tile near window	None
	Bulk	Carpet beneath water damaged ceiling tile	None
	Bulk	Spray-on Insulation above ceiling near windows	None
Room 317	Tape	Ceiling tile, south end	None
	Tape	South wall, behind coving	<i>Chaetomium globosum</i> <i>Penicillium/Aspergillus-like</i>
	Tape	South wall, 3 feet above floor	None
	Tape	Supply vent	None
	Tape	Return vent	None
	Tape	Wall on exterior side (comparison)	None
Storage Room	Tape	South wall	<i>Aspergillus sp.</i> <i>Chaetomium globosum</i> <i>Ulocladium sp.</i>
	Tape	Ceiling tile near water stains, north side	None
	Tape	Wall behind coving, south side	<i>Stachybotrys sp.</i>
	Tape	East wall (comparison)	None
	Bulk	Carpet below mold on South wall	None

TABLE 6
Results of Tape Samples, Roxbury District Court
Samples Taken March 15, 2006

Room	Location in Room	Fungal Growth
Hallway outside room 330	water damaged ceiling tile	None
	pipe insulation above water damaged ceiling tile	<i>Acremonium sp.</i> <i>Cladosporium cladosporioides</i> <i>Penicillium sp.</i> <i>Stachybotrys chartarum</i>
DA's Office, Support Staff	ceiling tile above file cabinet	<i>Acremonium sp.</i>
Room 165	window sill edge	None
	bottom of water damaged book	<i>Alternaria-like</i>
Room 162	carpet against exterior wall below windows	None
	wall behind coving on exterior wall below windows	None
	beneath carpet under work station	None
Clerk Area (near coat rack)	ceiling tile	<i>Acremonium-like.</i>
1 st Floor (near fire alarm control room)	water damaged newspapers under plants	<i>Alternaria sp.</i> <i>Ulocladium sp.</i> <i>Cladosporium sp.</i>
File Storage Room 113	water damaged papers in files (in file cabinet)	<i>Cladosporium sphaerospermum.</i>
Room 128	carpet at foot of desk	None
	water damaged box	None